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APPLICATION NO.	FILED DATE	EXAMINER AND OPINION NO.	EXAMINER'S OFFICE	EXAMINER'S PHONE NO.
09/000,000	01/01/2000	Matthew Shaw	703/305-2170	703/305-2170

Applied Materials Inc  
Patent Dept  
PO Box 450A  
Santa Clara, CA 95052

EXAMINER

OISEN, ALAN W

APPLICANT

PATENT NUMBER

DATE MAILED: 03/09/2002

Please find below and or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/507,629

Examiner

Allan W. Olsen

Applicant(s)

SHEN ET AL.

Art Unit

1746

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 18 February 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-43 is/are pending in the application.
- 4a) Of the above claim(s) 22-31 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11, 14-19, 32-34 and 36-43 is/are rejected.
- 7) ☐ Claim(s) 20, 21 and 35 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- \_\_\_\_\_ (to a provisional application) has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- \_\_\_\_\_ (to a provisional application) has been received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-848)
- 3) ☐ Information Concerning Drafting (PTO-413) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other \_\_\_\_\_

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## DETAILED ACTION

### *Election/Restrictions*

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-21 and 32-43, drawn to an etching method, classified in class 216, subclass 079.
- II. Claims 22-31, drawn to an apparatus, classified in class 156, subclass 345.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus could be used for substrate coating processes.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Ashok Janah on March 18, 2002, a provisional election was made with traverse to prosecute the invention of group I, claims 1-21 and 32-43. Affirmation of this election must be made by applicant in replying to this Office action. Claims 22-31 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

### ***Priority***

This application is identified as a CIP of an earlier filed application. However, the claim for priority is faulty in that this application (09/507,629) claims priority to itself (09/507,629).

### ***Specification***

The disclosure is objected to because of the following informalities:

the examiner believes the specification's errors by using the reference number "20" instead of --24-- in at least each of the following locations; page 8, lines 25 and 32; page 12, lines 1, 19, 28, 29, 30 and 31;

Page 15, line 35 - "Torr" should be --mTorr--;

Page 16, line 20 - "represents" should be --represent--;

Page 16, line 23 - "Torr" should be --mTorr--;

Page 18, in Table 5 - the column "Backside He Pressure" should include the unit --Torr--;

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**Claims 1, 10, 14, 15, 18 and 33 are rejected under 35 U.S.C. 112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The phrase "substantially similar" in claims 1, 14 and 33 is a relative phrase that renders the claim indefinite. This phrase is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claims 10 and 18 recite "...wherein the volumetric flow ratio of the fluorine containing and the chlorine containing gas to the sidewall-passivation gas...". Is the claimed ratio intended to be taken between the combined amounts of the fluorine containing and the chlorine containing gas with respect to the sidewall passivation gas and the, or must the (fluorine containing gas:sidewall-passivation gas) and the (chlorine containing gas:sidewall passivation gas) ratios be within the claimed range.

Claim 15 refers to a "polysilicon" etch rate. However, this claim lacks sufficient antecedent basis for the presence of polysilicon.

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***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**Claims 1-5, 7, 9, 11, 14, 15 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by EP 0 200 951 (hereinafter, Chen).**

Chen teaches a method in which similar etching rates are obtained for differently doped layers polysilicon (column 1, line 30 - column 2, line 4). The etching gas of Chen comprises a fluorine gas such as NF<sub>3</sub> or SF<sub>6</sub>, and a polymerizing gas (sidewall passivation gas) that is comprised of hydrogen. Chen teaches that a chlorine containing gas may also be added to the etching gas (column 2, lines 5-9 and column 3, lines 42-50). Chen does not teach adding HBr Br CHBr<sub>3</sub> to the etching gas. Chen does not explicitly teach the limitation of instant claims 5 and 15. However, because Chen meets all of the process limitations in claims 5 and 15, any claimed result is considered to be an inherent outcome of Chen.

**Claims 1-3, 5-12, 32-34, 36-42 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,605,601 issued to Kawasaki.**

Kawasaki teaches a method in which dissimilar silicon containing regions of a substrate are etched at approximately the same rate as indicated by an etching selectivity of approximately 1 for silicon dioxide relative to polysilicon (column 7, lines

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33-42). Kawasaki's method uses a plasma comprising  $\text{Cl}_2$  and  $\text{NF}_3$  with the  $\text{NF}_3$  comprising up to 70% of the total mixture (column 3, lines 2-5). One function of the  $\text{NF}_3$  component is to provide fluorine, an active etching agent. A second function is to provide nitrogen as nitrogen contributes to the sidewall passivation (column 3, lines 1-2). Kawasaki teaches a second etching step. The first and second steps differ in that the etching gas of the second step includes  $\text{HBr}$  (column 3, lines 21-26). Kawasaki does not explicitly teach that the etching rates of the dissimilar silicon containing materials are within about 5 % of each other. However, because Kawasaki meets each process limitation of claim 5 and claim 36, the claimed results is considered to be an inherent outcome of Kawasaki.

**Claims 1, 2, 6-11, 14 and 16-19 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,716,495 issued to Butterbaugh et al. (hereinafter, Butterbaugh).**

Butterbaugh teaches a method in which undoped and doped silicon oxides are etched at approximately the same rate (column 1, lines 15-19; column 2, lines 20-33; column 5, lines 15-36). Butterbaugh uses an etchant that comprises a chlorine gas and a fluorine gas. Butterbaugh also teaches adding applicant's sidewall passivating gas,  $\text{N}_2$ , to the etching gas mixture. Butterbaugh provides an example in which a F-gas:Cl-gas ratio of 2:1 is used. This same example demonstrates a (F-gas + Cl-gas): $\text{N}_2$  ratio of 3:1 (column 11, lines 10-14).

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**Claims 1-5, 7-9, 11, 14, 15, 17 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 4,992,134 issued to Gupta et al. (hereinafter Gupta).**

Gupta teaches a method in which allows polysilicon, n-doped polysilicon and p-doped polysilicon to all be etched at substantially the same rate (column 3, lines 42-44, column 4, lines 30-35). Gupta teaches the claimed chlorine and fluorine containing gases, for example Cl<sub>2</sub> and SF<sub>6</sub>. Gupta also teaches adding H<sub>2</sub>, applicant's sidewall passivating gas (column 2, lines 30-48).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 13 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawasaki.**

Claims 13 and 43 are dependent upon claims 12 and 42 respectively. Kawasaki teaches the limitations of claims 12 and 42 as noted in the above 102 rejection. Additionally it is noted that Kawasaki teaches that the etching gas mixture for the second etching step comprises an HBr/Cl<sub>2</sub> mixture.

Kawasaki does not teach using an etchant that comprises an HBr/Cl<sub>2</sub> mixture.



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It would have been obvious to one skilled in the art to use an HBr/Cl<sub>2</sub>/O<sub>2</sub> mixture as the etchant for the second step because Kawasaki teaches that the HBr/O<sub>2</sub> mixture and the Cl<sub>2</sub>/O<sub>2</sub> mixture are functionally equivalent as the second step etching gas mixture.

"It is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose." *In re Kerkhoven* 205 USPQ 1069 (CCPA 1980). Cites *In re Susi* 169 USPQ 423, 426 (CCPA 1971); *In re Crockett* 126 USPQ 186, 188 (CCPA 1960). See also *Ex parte Quadranti* 25 USPQ 2d 1071 (BPAI 1992).

Alternatively, Kawasaki does not teach adding helium to the HBr/O<sub>2</sub> mixture.

It would have been obvious to one skilled in the art to use add helium to the HBr/O<sub>2</sub> etching gas mixture for the following well known reasons on which the examiner takes Official notice. The inclusion of an inert carrier gas (e.g. helium) has a stabilizing influence on a plasma discharge. The use of an inert carrier gas provides better control over the flow ratio of the reactant gases. Operating under more stable plasma conditions and with an increased ability to control the flow rates of the reactive gases generally leads to more uniform etching results. Additionally, inclusion of inert gases also improves ones ability to control etching selectivity and etching profiles. Furthermore, because O<sub>2</sub> is typically supplied as a He-O<sub>2</sub> mixture it would be very convenient to use this readily available source of oxygen. Most important, however, is the fact that using a He-O<sub>2</sub> mixture in a plasma etching operation provides significant benefits with respect to safety.

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***Allowable Subject Matter***

Claims 21, 21 and 35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

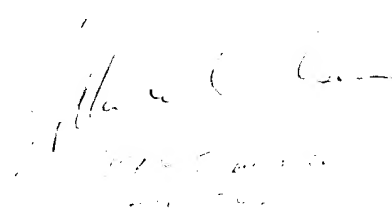
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is (703) 306-9075. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski, can be reached on (703) 308-4333. The fax phone number for this Group is (703) 305-7719.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen, Ph.D.

March 21, 2002

A handwritten signature in dark ink, appearing to read "Allan Olsen", is written over a faint, circular official stamp. The signature is slanted and written in a cursive style.